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# GEOLOGY OF MALTA

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The Maltese Archipelago consists of a group of small, low-lying islands located in the central Mediterranean, approximately 96km South of Sicily and 320km north of North Africa. The archipelago extends for 45km in a NW-SE direction. The largest islands are Malta and Gozo. The other islands of the archipelago are much smaller and comprise Comino, St Paul's Islands, Cominotto, Filfla and General's Rock.

The rocks of the Maltese Islands are all sedimentary and result from the accumulation of carbonate sediments in a relatively shallow marine environment. Various types of rocks correspond to different palaeo-environments of deposition. A second class of rocks, quaternary deposits, represent sediments that were deposited in a terrestrial environment following the emergence of the Maltese Islands above sea level. The origin of the Maltese Islands is related to the formation of the Mediterranean basin and may be traced to the Triassic.

During the Triassic era, rifting in Pangaea in an east-west direction produced a transverse ocean called the Tethys Sea. River sediments and reef deposits laid down on this early ocean bed were to become the precursors of the rocks that comprise the Maltese Islands. Further rifting in Pangaea resulted in the northward movement of what is now the African continent, with the consequent destruction of most of Tethys. This rotational movement is ongoing and has formed a zone of collision between Eurasia and Africa. The effects of this collision on the geology and geomorphology of the Maltese Islands are evident as faulting, uparching and subsidence of the sediments deposited in the proto-Mediterranean.

### **General Structural Geology**

Rifting in the vicinity of the Maltese Islands has resulted in alternate uplifting of various regions of the Maltese Islands. The most recent such episode has given the archipelago a tilt towards the north-east. The western regions of the islands are uplifted to form high cliffs while the eastern coastlines are drowned. The highest

point on the archipelago is 253m above mean sea level and is situated at Dingli Cliffs on the south-western coast. The tilt of the archipelago is responsible for the predominant north-eastern trend of drainage channels on Malta.

Malta is crossed by two main fault systems representing the effects of two separate rifting episodes in the vicinity of the archipelago. The older of the two, the Great Fault, trends SW to NE, while the Maghlaq Fault system trends approximately NW to SE along the southern coast of the island and has been responsible for the downthrow of Filfla to sea level. A system of horst and graben structures of East-Northeast trend characterises Malta north of the Great Fault. These structures are indicated by prominent ridges and valleys. No well-defined horst and graben systems occur south of the Great fault.

Several circular subsidence structures are distributed throughout the islands. The origins of these structures are various, but are mainly associated with solution of limestone by percolating acidified groundwater leading to roof collapse of subterranean or submarine caverns.

### **Stratigraphy**

Although the sedimentary platform on which the Maltese Islands are situated was formed during the Triassic, there are no surface outcrops of this age. All exposed rocks were deposited during the Oligocene and Miocene periods of geological time. No rocks of Pliocene age have been conclusively identified, indicating that definitive emergence of the archipelago above sea level probably occurred at this time. The rocks of the Maltese Islands are arranged in a simple layer-cake succession from oldest to youngest as follows:

- Lower Coralline Limestone.
- Globigerina Limestone
- Blue Clay
- Greensand
- Upper Coralline Limestone

These rocks are sporadically overlain by terrestrial, aeolian and alluvial deposits laid down following the emergence of the Maltese Islands above sea level. Much of the central and south-eastern portion of the Maltese comprises outcrops of Globigerina Limestone while the northern and north-western regions are characterised by highlands on which Upper Coralline Limestone is the dominant outcrop.

The geology of Gozo is more varied than that of Malta, with more frequent outcrops of Blue Clay being a characteristic feature. The abundance of Blue Clay on Gozo makes the soil particularly fertile. Gozo therefore produces most of the agricultural produce for the islands.

**Lower Coralline Limestone** is the oldest exposed rock in the Maltese Islands, outcropping to a height of 140m in the vertical cliffs near Xlendi, Gozo. It is mainly composed of the tests of coralline algae indicating deposition in a shallow gulf environment. Younger beds show evidence of deposition in more open marine conditions.

This lithology acts as the main aquifer for the island. It provides water for domestic and industrial use. Water supply is a big problem for the island especially during the tourist season. The government also uses several desalination plants to provide fresh water but this is very expensive.

**Globigerina Limestone** is the second oldest rock and outcrops over approximately 70% of the area of the islands, eroding to give a broad, gently rolling land-scape. Variations in the thickness of this formation are considerable, ranging from 23m near Fort Chambray, Gozo to 207m around Marsaxlokk, Malta. This rock consists of yellow to pale-grey limestones comprising tests of planktonic globigerinid foraminifera. The formation is divided into Lower, Middle and Upper Globigerina Limestone by two beds of phosphorite pebbles.

This lithology provides most of the building stone for the island. It also contains some very well preserved fossils.

**Blue Clay** overlies the Globigerina Limestone formation. It erodes easily when wet and forms taluses which flow out over the underlying rock. Variations in thickness are considerable

ranging from 75m at Xaghra, Gozo to nil in eastern Malta, where Upper Coralline Limestone rests directly on Globigerina Limestone. Deposition of the Blue Clay may have occurred in an open muddy water environment with water depths up to 150m for the lower part of the formation.

The Blue Clays act as an aquiclude to the water-bearing Greensand and Upper Coralline Limestone aquifers. These lithologies also provide some of the water for the island.

**Greensand** consists of bioclastic limestones rich in glauconite deposited in a warm sea. Unweathered sections are green but are oxidised to an orange colour when exposed. The deposit attains a maximum thickness of 11m in localised depressions at Il-Gelmus in Gozo, but elsewhere is less than 1m thick. There are many fossils to be found in the Greensand mainly bryozoa, gastropods and sharks' teeth. Larger fossils can be found but they are generally not very well preserved.

**Upper Coralline Limestone** is the youngest Tertiary formation in the islands, reaching a thickness of approximately 160m in the Bingemma area, Malta. Several significant depositional breaks occur towards the top of this formation indicating emergence on at least two occasions and in general the top of the formation is dominated by facies which imply deposition in very shallow water ranging from shallow subtidal to possible intertidal and supratidal environments.